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How can Psychology inform disaster research?

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Abstract

This paper will set out our current understanding of how psychology can help us to understand and influence preparation for, and responses to disaster. Using four primary research studies, this paper will outline how psychology can inform our knowledge of all stages of a disaster (preparedness, immediate response and long-term consequences). The first study used a questionnaire design to examine factors that influence evacuation behaviours. The second and third studies explored physiological and psychological responses to simulated disaster training. The fourth study explored the consequences of trauma exposure focusing specifically on predictors of post-traumatic stress disorder and post-traumatic growth. The results show that psychology can play a role in our understanding of human behaviour during a disaster. Specifically, study one shows how psychology can inform disaster preparation by identifying barriers to evacuation. The second and third studies show how psychology can help us to explore and predict human behaviour during a disaster. Finally, the fourth study highlights how psychology can help us to understand the longer-term impact of exposure to traumatic events. Overall, the results of these studies show that psychological knowledge can predict and positively influence human behaviour in response to disasters.

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Keywords: disaster management; psychology; evacuation; human factors; disaster; preparedness; resilience#

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1. Introduction

It is often thought that psychologists only have a role after a disaster has taken place, working to support victims and emergency workers. However, psychologists can make a positive contribution in helping people prepare for, and respond to, disaster situations. It is clear that preparing effectively for a disaster can increase your chances of survival. [1] What is currently unclear is why some people do not engage in disaster preparedness. For example, during the Mount St. Helens volcanic eruptions in 1980 some residents living next to the volcano lost their lives as they refused to evacuate. [2] Understanding why some people refuse to evacuate could help to save lives as interventions could be put in place to overcome identified barriers. For example, in the Western world it has been suggested that people may fail to evacuate if they are unable to keep their pet(s) safe [3] and that evacuation is more likely if provisions are made for pets during disasters. [4] Therefore, the first study in this paper will explore the impact of pet ownership on evacuation behaviours.

Psychological research can also help us to understand why during a disaster people can behave in ways that reduce, rather than increase, their survival chances. For example, in fire emergencies people can suffer cognitive failures and so make poor decisions, such as returning into the fire to collect personal items. [5] Psychological research suggests people in disasters show impaired cognition as complex decisions need to be made when time is limited and emotions are high. [6] However, less is known about the impact of situational factors and individual differences on behaviours during an emergency. In order to explore situational factors that can impact on behaviour during a disaster Study Two, using a simulated fire search and rescue mission, will investigate the impact of social support on self-report, and a physiological marker (cortisol), of stress. Previously, social support has been shown to reduce stress responses in people facing acutely stressful situations. [7] However, it has also been suggested that undergoing a stress experience in front of other people can lead a greater stress response if people fear a negative social evaluation. [8] Therefore, the second study explored whether social support mediates stress responses to a simulated fire emergency. To explore the impact of individual differences Study Three uses a simulated helicopter crash over water to explore the impact of a neurotic personality on cognitive processing under pressure. Neuroticism is characterised by anxiety, negative mood and distress proneness [9] and highly neurotic people have been found to cope poorly in acutely stressful situations. [10] Therefore, Study Three will investigate whether neurotic individuals are more likely to exhibit poorer cognitive performance during a simulated helicopter emergency.

Finally, Study Four explores the impact of individual differences (gender & optimism level) on people's levels of resilience to traumatic events. The majority of people will be resilient to trauma [11], however it is not understood why some people will suffer adverse effects, such as Post Traumatic Stress Disorder (PTSD). If the factors that predispose people to PTSD can be identified it may be possible to tailor therapies to either prevent or more effectively treat people post trauma. The two individual differences previously shown to impact on resilience to trauma are investigated in Study Four; (1) gender and (2) optimism. [12]

2. Study One

Study One was a questionnaire study and used correlational analysis to explore the relationship between pet ownership and evacuation behaviours. Ninety-three pet owners (40 dogs, 20 cats and 20 owning both, and 13 owning other pets, including snakes, spiders and horses) completed the questionnaire (mean age 24 yrs; age range 18 -78 yrs). First participants completed a 20 item Preparedness Questionnaire. Ten items related to general preparedness, and included questions such as "do you have a first aid kid or extra medical supplies available?" A further 10 items related to pet preparedness, including questions such as "Do you have a pet carrier to transport your pet in case of an emergency?" Participants responded Yes", "No" or "Uncertain" to the questions. A preparedness score was calculated for both general and pet preparedness, with a higher score indicating a higher level of preparedness. Next participants completed the Pet Attachment Questionnaire. [13] Responses to a number of statements, such as "When I think of losing my pet I become very upset." were indicated on a 5 point Likert scale (5=strongly agree to 1=strongly disagree). A higher score indicates higher attachment to a pet. Finally, participants were asked four questions relating to how likely they were to evacuate in a fictional disaster scenario. Questions included "I believe that the disaster would affect

me personally and so I would leave if instructed" with participants responded on a 7 point Likert scale, ranging from (7=extremely likely to 1=extremely unlikely). A higher score indicated an increased likelihood of evacuation. Table 1 below displays the correlation results.

Table 1: Correlational analysis for Pet Preparedness, Pet Attachment, General Preparedness and Evacuation behaviours.

1.	2.	3.	4.		
1. Likelihood of Evacuation	-				
2. Total General Preparation	.08	-			
3. Total Pet Preparation	.46**	.27**	-		
4. Total Pet Attachment	.40**	.05	.55**	-	

** Correlation is significant at the .01 level.

The results show that pet attachment does have an impact on evacuation behaviours. There is a significant positive correlation showing that higher pet attachment scores were associated with a greater risk of an owner not evacuating ($r = .40$, $p<.001$). Further, there is a significant positive correlation which suggests that the more unprepared owners are with regard to their pet evacuation plan the higher the likelihood that they will not evacuate ($r = .46$, $p<.001$). In addition, a significant positive correlation shows participants with higher general preparedness also have higher pet preparedness ($r = .27$, $p<.001$) and higher pet attachment significantly correlates with more pet preparation ($r = .55$, $p <.001$).

Study one helps to illustrate how factors such as pet ownership can have an impact on people's evacuation behaviours. It is clear that both pet owners and those responsible for disaster planning should make preparations for their pet in case an emergency situation necessitates evacuation. Preparation could include owners making sure that pets have a bag of pre-packed essential items, such as food and medication, ready for emergency evacuations. Disaster planners could make sure that evacuation centres have housing for both pets and pet owners. Future research could explore why people are not engaging in pet preparedness. Research on general preparedness behaviours indicates that barriers can include denial that a disaster will happen or the lack of resources to undertake preparedness behaviours. [1] Future research could explore whether barriers to pet preparedness are the same as those observed with general preparedness. Once the barriers to pet preparedness are understood, effective, evidence-based interventions can be instigated. Finally, it is important that culture may have an impact on whether pets are a barrier to surviving a disaster. In the United Kingdom and America people have high levels of attachments to their pets. The high level of attachment to pets may not be present in other countries. Further research could explore whether the results found in the current study reported here are replicated in other cultures.

3. Study 2

Study two explored the impact of a simulated fire search and rescue mission and the mediating effect of social support on participant's self-reported stress levels and physiological strain (cortisol levels). Thirty-nine participants (34 male; mean age 24 yrs; age range 18-37 yrs) were recruited via opportunity sampling from a fire-fighting training course at Fleetwood Nautical College (England, UK). Participants were divided into high and low social support with those reporting less than10 friends on the course considered 'low' in social support and those with 10 or more friends being considered 'high' out of a typical group size of 20.

During the simulated fire search and rescue mission participants provided saliva samples (which were analysed for cortisol levels) and self-reported stress levels at three time points. Self-reported stress levels were monitored using the stress subscale of The Stress Arousal Checklist. [14] This subscale has 19 positive and negative adjective mood-related words, such as 'Worried' or 'Peaceful.' Participants read the words and then selected a response which best

described their current state from the options: 'Definitely Feel', Slightly Feel', 'Cannot Decide' and 'Definitely Do Not Feel'. A value of 1 was assigned if the positive adjectives 'Definitely Feel' or 'Slightly Feel' or the negative adjective options 'Cannot Decide' or 'Definitely Do Not Feel' were selected. Otherwise a value of 0 is given. The maximum score was 19 with a higher score indicating higher subjective stress levels. Below Table 2 shows the descriptive statistics.

Table 2: Means (with standard deviations) for self-reported stress level for participants with high and low social support levels across the three time points.

Time Point	Low Social Support	High Social Support	Mean Totals
T1.Immediately Prior	3.53 (3.17)	5.82 (3.63)	4.61 (3.54)
T2. Immediately Post	6.84 (4.18)	9.24 (4.87)	7.97 (4.61)
T3. One hour Post	3.79 (3.99)	7.00 (5.14)	5.31 (4.79)
Mean Totals	4.72 (3.78)	7.35 (4.55)	

A 2 (Social Support; high, low) x 3 (Time Point; T1, T2, T3) mixed ANOVA was undertaken to examine the impact of social support levels on self-reported stress levels. A significant main effect of time ($F(2, 68) = 6.96$, $p = .002$) was revealed and so a series of post-hoc paired samples t-tests was undertaken (adjusted alpha level $p<.017$). Stress levels were significantly higher at T2 compared to T1 ($t(38) = 3.18$, $p <.001$) or T3 ($t(37) = 2.71$, $p = .010$) but no differences were found between T1 and T3 ($t(37) = .79$, $p = .434$) suggesting stress levels were higher immediately following the fire exposure compared to immediately before or an hour later. A significant main effect of social support was also revealed ($F[1, 34] = 192.42$, $p <. 001$). A comparison of the means in Table 2 suggests participants in the high social support group experienced higher stress levels than those in the low social support group. The interaction effect between time and social support was non-significant ($F[2, 68] = .14$, $p = .870$).

Participant's cortisol levels were also recorded as a measure of participant's physiological response to the simulated fire emergency. Below, Table 3 displays the descriptive statistics.

Table 3: Mean cortisol levels in nmol/l (with standard deviations) for participants in the low and high social support groups across the three time points.

Time Point	Low Social Support	High Social Support	Mean Totals
T1.Immediately Prior	5.31 (3.42)	4.95 (2.65)	5.12 (2.95)
T2. Immediately Post	12.34 (6.90)	6.99 (5.34)	9.51 (6.53)
T3. One hour Post	16.92 (11.95)	13.57 (11.21)	
Mean Totals	11.52 (7.42)	8.50 (6.40)	

A 2 (social support; high, low) X 3 (Time point; T1, T2, T3) mixed ANOVA was undertaken to explore the impact of social support level on cortisol responses over the course of the simulated fire search and rescue exercise. A significant main effect of time was revealed ($F(2, 30) = 8.42$, $p < .01$). Post-hoc analysis using paired samples (adjusted alpha level $p<.017$) revealed higher cortisol levels at T2 ($t(18)$, $p = .005$) and T3 ($t(18)$, $p = .005$) compared to T1. No significance difference in cortisol levels was observed between T2 and T3 ($t(19)$, $p = .055$). No main effect of social support ($F(1, 15) = 1.50$, $p = .239$) and no significant interaction between time and social support was observed ($F(2, 30) = .52$, $p = .600$).

Although it was expected that social support would offer a buffering effect and reduce people's stress responses this was not observed. Instead, people with more friends appeared to self-report higher levels of stress. This suggests that having friends on the course can lead to more social-evaluative stress. [8] This finding highlights the need for

good team building to remove social evaluative pressure from within emergency response teams. Interestingly, although the physiological marker (cortisol) did increase as a result of exposure to the fire emergency, people's cortisol responses were not influenced by their level of social support. This finding highlights the importance of using a range of outcomes measures in psychological research. In conclusion, environmental factors, such as group dynamics, can impact on responses to simulated disasters. Research which examines the influence of other environmental factors, such as dehydration status or sleep deprivation should be undertaken.

4. Study Three

Study Three explored the impact of a simulated helicopter crash into water using the Helicopter Underwater Evacuation Training (HUET) scenario on participants' mental processing (Letter Cancellation Task). Thirty-five male participants (mean age = 41.29 yrs; age range 22 - 64 yrs) were recruited from Fleetwood Nautical College. Before HUET, participants completed the 20 item neuroticism scale [15]. The scale comprises 20 statements, such as "I am filled with doubts about things" or "I remain calm under pressure." Participants indicated on a 5 point Likert scale how much they agree with the statement (1=strongly disagree to 5=strongly agree). Negatively coded statements were reverse scored before the responses were summed. A higher score demonstrated higher levels of trait neuroticism. After completing the neuroticism scale participants completed the HUET. During HUET participants were strapped into a helicopter simulator suspended over a pool. On command participants adopted the crash position whereupon the helicopter underwent a rapid but controlled ditching into the water. Participants undertook between 4 and 7 simulated crashes which involved at least two straight submersions and two ditches which involved submersion and 180˚ rotation. Participant's cognitive performance using The Letter Cancellation Task was measured at three time points; immediately before the training (T1), immediately after the training (T2) and one hour post training (T3). The Letter Cancellation task measures a range of cognitive functions. [16] Participants are given an A4 sheet displaying 650 letters dispersed at random intervals across the page. Three hundred letters were the target letters (e.g. 'A', 'S' and 'W'). Participants had two minutes to strike through as many target letters as quickly and as accurately as possible. The total number of target letters marked was recorded. Descriptive statistics are noted below in Table 4.

Table 4: Means (with standard deviations) for performance on The Letter Cancellation Task for those in the low and high neuroticism groups at three time points during the Helicopter Underwater Evacuation Training.

Time Point	Low Neuroticism	High Neuroticism	Mean Totals
T1.Immediately Prior	136.40 (41.84)	132.20 (25.35)	134.60 (35.32)
T2. Immediately Post	139.45 (26.56)	120.07 (27.24)	131.14 (28.18)
T3. One hour Post	123.10 (22.69)	115.53 (32.88)	119.86 (27.34)
Mean Totals	132.98 (8.69)	122.60 8.62)	

A 2 (neuroticism; high, low) x 3 (Time Point; T1, T2, T3) mixed ANOVA was performed to examine the impact of neuroticism and HUET training on participant's Letter Cancellation Task score. A significant main effect of time was revealed ($F(1.53, 50.53) = 10.88$, $p < .001$) indicating that participant's scores on the cognitive task differed across the three time points. Further analysis (post-hoc paired samples t-tests) indicated that cognitive performance at time point 3 (one hour after HUET) was significantly lower than at time point 1 ($t(34) = 3.83$, $p = .001$) or time point 2 ($t(34) = 4.62$, $p < .001$). No other comparisons were significant. No significant main effect of neuroticism ($F(1, 33) = 1.16$, $p=.289$) and no significant interaction effect was observed ($F(1.53, 50.53) = 2.93$, $p = .076$).

Study 3 examined whether exposure to a simulated helicopter crash could result in changes in cognition similar to those seen in real-life. The results show that although exposure to HUET did impact on cognition, the decline in cognitive performance was only seen one hour after HUET, whereas cognitive performance immediately before and after training was preserved. This finding supports previous research that found evidence of a "cognitive collapse" in the period following a fire-fighting exercise. [17] The results of this study have important implications for disaster managers, as they should be aware that both emergency response teams and victims may appear to have normal

cognitive functioning immediately following a disaster but may show impairments in cognition a short time later. Interventions that could reduce the risk of cognitive collapse, such as energy drinks [18] could also be used. However, psychological research is still needed to identify which specific cognitive functions fail, and at what time point, in a disaster.

5. Study Four

Study Four used a questionnaire design to explore gender differences and the impact of trait optimism on resilience to trauma. An opportunity sample of 80 participants completed the questionnaire recording their gender and then completed a dispositional optimism test to measure their resilience to a recent traumatic event. Dispositional Optimism was measured using the 10-item revised Life Orientation Test scale [19] and included questions such as "In uncertain times, I usually expect the best." Participants rate each item on a 5-point Likert scale (0=Strongly Disagree to 4=Strongly Agree). The negative items (3, 7, & 9) were reverse coded and the total was summed with the filler items excluded. Scores ranged from 0-24, with a higher score indicating greater levels of dispositional optimism. Resilience was measured using The Resilience Scale, [20] a 14-item scale which measures people's ability to cope effectively when placed in adverse situations. Participants read statements such as "I usually take things in my stride" and responded on a 7 point Likert Scale (1=strongly agree to 7=strongly disagree). The responses were summed and a lower score indicating a higher level of resilience. Table 5 below details the descriptive statistics.

Table 5: Mean (and standard deviations) resilience levels for male and female participants in the High/Low optimism groups.

Time Point	Low optimism	High Optimism	Mean Totals
Male	31.50 (8.78)	31.08 (16.58)	31.31 (12.69)
Female	39.42 (11.84)	27.48 (7.33)	34.60 (11.77)
Mean Totals	36.96 (11.49)	28.79 (11.46)	

A 2 (gender; male, female) x 2 (optimism; high, low) between participants ANOVA revealed a significant main effect of optimism on resilience ($F(1, 74) = 5.18$, $p < .05$). A comparison of the means in Table 5 suggests that those who are high in optimism have better levels of resilience. However, no significant main effect of gender was observed ($F(1, 74) = .630$, $p = .430$) suggesting that the gender does not significantly influence levels of resilience. Finally, a significant interaction between gender and optimism ($F(1, 74) = 4.503$, $p = .037$) was discovered. Post hoc t-tests (adjusted alpha level $p < .0125$) revealed that female participants who reported higher levels of optimism were significantly more resilient than those who had low optimism ($t(49.70) = 4.113$, $p < .001$). No other significant differences were observed.

Study 4 examined whether the personality trait of optimism influenced people's resilience to trauma. The results suggested that higher levels of dispositional optimism did positively impact on levels of resilience but only for women. Women who reported high levels of optimistic thinking also reported lower scores on the resilience scale indicating a better resilience to a recent traumatic event. Understanding factors that can influence resilience to trauma may help in the design of both preventative and therapeutic interventions which take individual differences into account. It is also important to consider whether interventions are appropriate for all the population or whether interventions need to be tailored to different groups within a population. Further research is needed to explore whether other individual differences, such as age, socioeconomic status, or personality types, can impact on how people respond to trauma. Only once we have a good understanding of how different populations respond to trauma will it be possible to tailor

interventions appropriately. For example, the results of this study suggest that teaching optimistic thinking will improve the resilience of women to trauma but may not be as useful for men.

6. Conclusions

This paper outlined four studies which clearly illustrate how psychology can inform our understanding of disasters, and their management. Study One outlined how a common factor, such as pet ownership, can have a major impact on how people respond in a disaster [3]. Pet ownership can lead to people not engaging in evacuation behaviours, which means that they could put themselves at risk of harm. By undertaking psychological research which identifies potential barriers to compliance with emergency instructions, disaster planners may be able to design and implement interventions. The field of psychology, therefore, has a role to play in identifying barriers to preparedness and evaluating any suggested interventions.

Psychology can also highlight factors which influence people's survival chances during a disaster. Study Two examined whether the presence of friends during simulated disaster training can affect individual's responses. Previous research suggests social support can have a positive impact, reducing stress responses to acutely stressful situations [7]. However, the results of Study Two illustrate that the mediating effects of social support are not straightforward, with participants who had friends on the course reporting higher levels of psychological stress. One explanation is that the presence of friends led to higher levels of social-evaluative pressure [8] and people felt they were being critically evaluated on their performance. Potential solutions include increasing team-building prior to training or offering training to groups of people who do not know each other.

As well as exploring the impact of mediating psychological factors, it is also important to examine the impact of emergency situations on cognition. If, during a disaster, cognitive performance becomes impaired then a person's chance of survival decreases as processes, such as decision making, become compromised. Study Three highlighted the phenomena of cognitive collapse, in which cognition appears preserved until the threat is removed. Once the threat is removed, people show specific cognitive impairments. This finding is important for emergency service workers to be aware of, as disaster victims may appear cognitively intact immediately post rescue but show marked cognitive impairments shortly after. Once psychologists have identified elements of cognition that can become impaired then it may be possible to design interventions to support people in disasters e.g. better training.

The final study, Study Four, explored factors which can help people to be more resilient to trauma. The results of Study Four suggest that one of the factors which may influence resilience to trauma is gender, with women who had lower levels of optimistic thinking having lower resilience to trauma. This finding suggests that women who are likely to be exposed to trauma, such as emergency service workers, could increase their resilience by developing an optimistic mind set. However, men may not benefit from interventions based on increasing optimistic thinking. More work is needed to explore gender differences in how people respond to trauma as this could lead to gender specific interventions/therapies.

Overall, it is clear that if disaster planning is undertaken without considering the influence of environmental and psychological factors then plans may be flawed and the survival rate of those populations affected may be lower. Currently our understanding of the psychology of survival is limited and more research is needed.

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